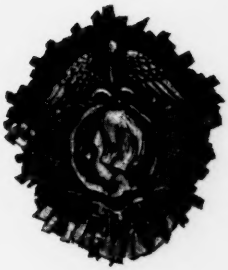
Journal of Dentistry for Children



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Vol. XII — FOURTH QUARTER — 1945

CONTENTS

Psychology of the Child as a Dental Patient 85
Ernest F. Ritsert, D.D.S.

The Composition and Behavior of the Silicate Cements 90
Fred Wertheimer, D.D.S.

Secretary's Message 97

Editorials 98

Around the Country 102
Stanley Brown

Pulp Tissue Reaction to Instrumentation during Cavity Preparation 105
John E. Chrietzberg, D.D.S., M.P.H.

The Influence of Habit Patterns on Prevention and Control in Pedodontics ... 110
George W. Teuscher, D.D.S., M.S.D.

Psychology of the Child as a Dental Patient

ERNEST F. RITSERT, D.D.S.

Editor's Note:

Ernie Ritsert is one of the original members of the Pennsylvania State Unit and one of its Past Presidents. He is an alumnus of Temple University School of Dentistry (1928), where he is now Assistant Professor of Pedodontics and Assistant Director of the Klahr Children's Dental Clinic.

A member of Omicron Kappa Upsilon, XI Psi Phi and the Academy of Stomatology, Ernie has written several articles on dentistry for children and contributed to a text book on the subject. We hope he joins our list of contributors again in the near future.

A. E. S.

Psychology is the study of the mind and its attendant phenomena. It deals with human behavior and emotional development as a part of mental growth, both of which are dependent on heredity and environment. It must be understood that it is not the premise of the dentist to attempt to take the place of the psychiatrist who has had special training and has made the study of the child's mind a lifetime work. It should, however, be his responsibility to have a sufficient knowledge of the subject to satisfactorily handle his child patient and to carry out an operation once begun to a successful conclusion.

The hereditary tendencies are a native endowment to all of us and cannot always be subjugated but they can be to a large degree wilfully controlled. The environmental traits could be fostered and developed through a number of positive patterns until we have reached what we might hopefully call the perfect patient. Such development must of course be started at the very beginning of the child's ability to understand the meaning of any emotional experience that may arise and which may have a bearing on his or her future mental attitude. The answer to the problem of the unruly child patient is apparent; we should like to prevent undesirable patterns from becoming established in them and find a way to ensure favorable emotional attitudes toward our profession.

It is common knowledge that all children are mimics and learn by imitation and suggestion. Unfortunately, all too frequently the child's early conception of dentistry is one in which an adult member of a family circle will discuss at great length what, to them, has been a harrowing experience in the dental chair. Usually this will be a case of self-pity and a desire for sympathy but it can hardly be called a positive pattern. Why will a parent use the dentist as a threat to make the child behave when the parent knows that the child will sooner or later require his services?

Psychologists are generally agreed that there are three recognized behavior patterns at birth; fear, from a loud noise or from falling; rage, from being restricted in movement; and love, such as from rocking, tickling or patting. Fear of the dental chair is an acquired emotion and is not therefore, a natural condition.

How much better it would be for all concerned if the child were given a mental picture of a pleasant, friendly fellow who has a great interest in little girls and boys. The child should be brought with the parent to the office at the earliest possible age, simply to observe and become acquainted with the office procedure. This might best be done when the parent is to receive oral prophylaxis. Seat the child in a small chair in the operating room and pay no attention at all to him. Usually this new experience will hold the little one's interest until the operation is complete. Before the child leaves the operating room it only takes a moment to seat him in the chair, say a few pleasant words in a quiet voice, tell him how glad you were to see him and that he must come again soon. The reaction of the child's mind is bound to be most favorable

and the foundation for a co-operative patient has been laid. It is at this visit that we should impress the parent with the fact that during the pre-school years personality is most flexible and is best conditioned to dental office experience.

The majority of our child patients accepts the need for dental care as they do other things in life—in a matter of fact way, as "something that must be done, so let's do it." There are times, however, when we come across the patient that definitely "stumps the experts" and there is no recourse other than to call on the knowledge that we may have and go ahead as best we can. What are some of these problems and what are their solutions? As before stated, emotional foundations are laid in the home; so it is quite natural to believe that what will bring results in the home should certainly bring results elsewhere. A behavior disorder is often due to mismanagement of the child at home or to his assocation with a maladjusted parent. We know that parents should be educated to learn and follow a few simple rules; that they should treat their children with kindness and respect but at the same time if a certain amount of disciplining is required, it should be given in no uncertain manner. These things we, as dentists, cannot teach the parents. We can, however, suggest changes in the home emotional attitudes when the occasion demands. Needless to say, such suggestions often require a great deal of diplomacy and tact.

Children have been divided into groups relative to their emotional characteristics and in order to clarify the divisions of the problem children met in the dental office, it might be well to classify them in certain groups and present a few instances of behavior problems of varying severity. There is first, the shy, retiring individual who sits on his mother's lap or hangs around her chair while awaiting admittance for treatment and portrays a perfect example of inferority complex. He is usually an only child and has been babied to such an extent that any slight discomfort calls for immediate sympathetic attention from mama. The wise operator will have the mother well out of call, preferably on a shopping tour, until the appointment is completed. This child begins to whimper as soon as he enters the office and cries during the entire operation. It is difficult not to lose patience but a little understanding will go a long way to achieve desired results.

In a quiet, confident voice, talk to the child, explain to him how important the treatment is, how proud his Dad will be of his bravery and of the sacrifices our soldiers and sailors are making compared to what we ask of him, to be well and strong. Suggest to his mother that the child be given an opportunity for mass play, for this child is more to be pitied than censured. One such instance is the case of Robert B., age seven years. Robert is an only child and I am sure that he receives entirely too much sympathetic attention in the home. He begins sobbing as soon as the bur is placed in the handpiece and the tears are quite copious during the entire operation. This child has been receiving treatment for over three years and he has never been entirely cured of this emotional reaction. I do not censure him nor do I sympathize but disregard the tears and proceed to do the work apace, giving him a word of encouragement now and again. Operations begun are always completed with an occasional few minutes rest. There is a history of a previous unpleasant experience during dental treatment that is deeply ingrained in this boy's mind and it will take many years of patience to completely overcome it. However, he is gradually improving and I believe will eventually become a good patient.

Fear or an unusual display of timidity in a child are serious behavior disorders and may be due to an underlying emotional disturbance due to a feeling of insecurity. To handle such a child requires a great deal of patience. Do not push treatment or prolong the visits. Gradually instill through your own personality the strength and courage that you feel the child needs. There will be a great deal of satisfaction in your ability when this patient is completed. Make a friend of this child and you will have a friend for life because he will feel secure in your confidence. One of the most frightened children I have ever met was Edward O., age nine years. His background was not good, there was considerable friction

in the home as the parents eventually separated and the child was forced to live with his grandparents. No doubt there were many unpleasant episodes that had made a most definite impression on him.

During his first visit he watched every move with dire apprehension and when work started he grabbed my hands and slid down in the chair almost to the floor. He was lifted back and given a good understanding of what was expected of a boy of his age in the office. During treatment there was always a steady monologue of encouragement and considerable compliment when the operation was proceeding satisfactorily. It is extremely difficult to break the "hand grabbing" habit. Usually during the period of understanding the child should be reminded that the instruments used could certainly cause damage if the operator's hand were to slip. Although the following may appear unorthodox, it has been quite successful. Usually the preliminary operations on the teeth require the use of abrasive stones, so, as the child grabs the operator's hand, slide the handpiece out of the mouth and run the revolving stone over the back of the child's hand at the same time stopping the motor. This will cause a reflex reaction and the hands will lower rapidly. The stone must be a well rounded one and as it is revolving slowly no damage could be done. Admonish him and explain how grabbing your hands have caused you to slip and if it happens again the results may be much worse, a cut tongue or cheek being the possible outcome of such a move. Continue the operation immediately and caution the child against grabbing the hands again.

Another of the symptoms of behavior disorder in children is the tantrum, which is nothing more or less than an unpleasant display of temper. Tantrum spells cannot be handled by a dentist who is also in a temper. It is understandable how one could "fly off the handle" but the first requirement is to remain calm. Do not raise the voice or scold for the more confusion created, the happier our young problem will be, because that is exactly what he is after. When composure is maintained, a friendly encouraging talk may be all that is necessary to proceed with the operation. If the patient is not in need of immediate treatment due to odontalgia a prophylaxis might be given and the patient dismissed. There are times, however, when it is necessary to begin work immediately and it seems almost impossible to reason with the patient. The child should be given a very definite understanding that you mean to give treatment and that it will be given regardless of their feeling in the matter. One such experience of a child in this category was Jane G., age seven. Jane is a second child of middle-age parents, her older sister being twenty-four years of age. The parents told me that the child was spoiled and I was forced to agree with them after my contact with her.

She refused to enter willingly so the father carried her, kicking and screaming, into the operating room. We had been made aware of what to expect so we arranged to have the office empty of patients. The child was forced into the chair and the father was advised to leave the office and return in thirty minutes. It was apparent that reasoning was out of the question so drastic treatment was decided on and accomplished in the following manner. The operator places the arm behind the headrest, with the left hand holding a towel over the mouth of the child while the assistant and the operator's right arm hold the child in the chair. When the crying is silenced, talk softly and directly into the child's ear, explaining that you will remove your hand as soon as the crying stops and he will cooperate. If the child continues to carry on, close the nose with the thumb and forefinger, cutting off the air supply. Continue to talk to the child and gradually release the hand. If the screaming starts again, replace the towel over the nose and mouth. At this moment the operator may weaken, but after going this far, to stop now would be futile and all past efforts would be wasted. The child will experience much discomfort and gradually understand that you mean business.

After the child agrees to open the mouth, do not lose the advantage but use a dictatorial tone of voice and let him know that you are going to proceed and any interruption will mean a repetition of the previous experience. When the parent returns explain in front of

the child that is was necessary to silence the crying with the towel but make it a point to say that the unpleasantness is forgotten and that the child has promised to cooperate in the future. Usually the parent is so grateful and surprised in the sudden change in behavior, that if mention is not made of it, the child will later be questioned and with the usual childish imagination build the experience up to a point where there may be unjust criticism of the dentist's action. Such a procedure is the exception rather than the rule and it should not be used except as a last resort. These children eventually make fine patients and the child previously mentioned has become a very good friend.

There are times when we are called upon to operate on mentally abnormal children and each one of these presents a different problem. They all have one trait in common; they are very tardy in complying with suggestions made by the operator, so do not force the child with garbled talk but enunciate plainly and distinctly with emphasis and wait for your command to take effect. These children are poor patients at best but give them your every consideration. Caution should be followed when placing the fingers in the mouths of these patients for the desire to bite and chew is quite predominant and injured fingers can be most painful!

Children are quick to understand changes in the tone level of a voice. When engaged in operative procedure a quiet steady flow of simple words tends to take our young patient's mind away from his situation. Always keep the conversation at an age level with the child. Talk about his school, his playmates and other things of interest to him. At times it may become necessary to change the tone of voice to command respect and attention.

If it becomes necessary to do a painful portion of the operation, explain what you are about to do and why it might be a little unpleasant. Do not say it will not hurt when you know that it will. If you would win a child's respect always tell the truth. A child that is forewarned is forearmed and by simple explanation may be readied to bear any discomfort.

One of the most important facts to remember about handling children is to recognize them as persons and to respect their emotions and intelligence. Do not talk simply to make conversation, nor scold and belittle or tease them by calling them baby. Encourage the child to take an interest in what you are doing by assisting in some simple operation. The use of bribes to achieve success is generally a poor practice but it must be said it sometimes get results. The achieving of some small reward after successful completion of a visit will fill the young heart with pride. The little booklet that tells of the teeth and their care, or a toothbrush or some other small reward is one that is truly appreciated.

It has often been said that first impressions are lasting ones. It would be well then to consider the problems of the waiting room and it should be mentioned here, that one should never keep a child waiting more than fifteen minutes. A corner nook that the children know is completely their own, containing a table and small chairs with suitable, clean, up-to-date literature for varying ages is sufficient. The use of toys that all the children will handle is frowned upon by intelligent parents as possible carriers of disease. It is not necessary to turn the waiting room or office into a nursery or three ring circus in order to achieve respect. A quiet, refined atmosphere that suggests the importance of the visit will appeal to the child's taste.

The child that is greeted by name, by a cheerful smiling assistant and made to feel welcome has been influenced in the right direction. Children are quick to sense the fact that they are not wanted. The sympathetic, friendly assistant can be most valuable in all operative procedures on children. The gentle touch of a hand at a trying time helps to alleviate unpleasantness.

Appointments for children should be made during the morning hours since they are well rested and will respond more rapidly to treatment. The child that is tired and overwrought is usually a poor patient. It is a pleasure to note that our educators have finally become convinced that a well formed mind in a sickly or poorly formed body is uncongruous if not impossible, and we are now able to bring the children of school age into the office during the morning hours. Appointments of young children should be limited to the amount of

time the patient can tolerate treatment. Some of your young phlegmatic individuals never seem to tire while the next one has had more than enough after fifteen minutes. No set rule can be made but certainly a maximum of thirty minutes is sufficient.

There is some diversity of opinion as to whether the presence of the parent in the operating room is a help or hindrance. As a general rule their presence serves no useful purpose. Certainly they have confidence in your ability or they would not have brought the child in the first place and the side remarks and general directions usually tend to disrupt rather than aid in the proceedings.

Our contact with our child patients may be looked on with either pleasant anticipation or with dire forboding. Should there be one among us with an abhorrence to the treatment of children, certainly we should take stock of our professional attributes and should remind ourselves that there was a time when we too were such. During the initial visit of the child to the office, while the dentist has been classifying the little one into his emotional category, isn't there a possibility that the child has also been classifying the operator? Never lose sight of the fact that the successful campaign is one that is well planned even though it takes but a moment to plan it. The dentist the begins to operate with determination and assurance rather than the one who is filled with indecision, is the one that will receive the respect of children. They are quick to sense the lack of assurance and will readily take control of the situation. To illustrate the point, consider the spirited horse that has run away because the rider showed himself to be timid and fearful and because he failed to keep a tight rein or be master of the situation. Do not let the child run away with you.

It might be well when we consider the personalities of our young patients to spend a brief moment examining our own. Possibly we should analyze ourselves to see why we are not getting along with them the way we should. There are various individual differences in each of us and it is a foregone conclusion that there are not two of us alike. There is the introvert who lives in his own world and is sufficient unto himself. Our profession, confining as it is, may not be conducive to outside contacts and there is therefore, especially in this individual, the possibility of the narrowed viewpoint. Unfortunately there are many such in our profession. The child that disturbs this individual's equilibrium is shown the door or receives careless dentistry so as to be done with this extraneous annoyance in a hurry.

Then there is the extrovert, who bubbles with enthusiasm, who likes children for the youth they bring and for the sharing of it. They are attracted to him and enjoy being with him. It is impossible for us all to be continually jovial but we can take a leaf from this fellow's book and profit by it.

Lastly there is the great human mass known as the ambivert type, a middle grouping between the two previously mentioned. There falls the majority of us and we should try to stimulate or modify whichever tendencies we may have to either extreme. In final analysis, we must try to understand ourselves before we can attempt to understand others even though they be children.

There are many ways to foster a better understanding of the problems of children. One of the finest is to associate oneself with some charitable or organizational work dealing with them. There are many opportunities, such as neighborhood boys' clubs, Boy Scout work, church activities and many other organizations, dealing with the underprivileged child. Get out of your office; if you want to understand children you must mingle with them. Approach the problem with confidence and dentistry for children will be a pleasure rather than a burden. There are many, many millions of children needing dental care in this glorious land of ours and it is our responsibility to see that they receive this treatment in the dental office. Shaw has said, "Life is a flame that is always burning itself out, but it catches fire again every time a child is born." There can be no greater satisfaction afforded a member of our profession, than to see the growth and development of a young patient into a fine healthy adult, with a well shaped and well developed masticatory apparatus and know that his hand played a most definite part in shaping this fine specimen. This then, is the reward we all seek, a healthier, happier child in a healthier, happier world.

The Composition and Behavior of the Silicate Cements

By FRED WERTHEIMER, D.D.S.

Editor's Note:

Genial Fred Wertheimer was born in Frederick, Maryland, and is a graduate of Baltimore College of Dental Surgery, 1918.

He has been associated in a dental capacity with the Health Departments of Flint, Saginaw and St. Joseph, Michigan, and the Boys' Club of Detroit. At present he is working with Bill Davis and Ray Taylor in the Dental Division of the Michigan State Health Department at Lansing.

One son, whom I remember meeting and recognizing as good material for a dentist some years back, is now a student at Ann Arbor, where he is trying to convince Ken Easlick that the dental ability in the Wertheimer family has been passed on in increased measure to himself! *A.E.S.*

It has been estimated that dentists in the United States insert approximately eleven million silicate cement fillings each year.[1] Any dental material which has such widespread acceptance, especially when its use generally is limited to anterior teeth, warrants a review of its various properties in an endeavor to ascertain why it enjoys such acceptance by the dental profession and whether or not it merits this popularity.

History

Historically, one of the early references[2] gives credit for the discovery of silicate cement to Fletcher who, in 1878, patented a material of this type and placed it on the market. The venture was a failure and for around a quarter of a century silicate cement as a subject almost disappeared from the dental literature.

In 1904 a German dentist named Ascher marketed a silicate type of cement which had been developed by the chemist, Steenbock.[3] The material, which was called "artificial enamel," was still sold in the United States after the beginning of World War II.

Following the introduction of Ascher's product, several other silicates rapidly appeared and this type of cement was heralded widely as the long-sought perfect filling material. In addition to its ease of manipulation and insertion into the cavity while still in a plastic mass, it was also advertised to restore the natural appearance of the tooth.

Most dentists long had been wishing for a material of this kind, hence they became enthusiastic and accepted the new silicate cements widely without subjecting them to a proper period of experimentation. Soon the beautiful fillings began to discolor and disintegrate in the mouth and many pulps began to die under them. Then the initial enthusiasm rapidly changed to condemnation and silicate cement was held in disrepute by most dentists.

According to Hess,[4] there followed a long slow swing of the pendulum of experience in which there was a gradual improvement involving many factors. Cements of higher well as precautions which must be observed in care of the liquid, became better understood. Protective varnishes were inserted between the tooth structure and the material, while the limitations to its successful use were recognized.

Today, silicate cement maintains a definite place in restorative dentistry and a large percentage of fillings in anterior teeth are made from this material.[5]

Composition

The composition of silicate cements always has been a closely guarded secret of the manufacturer, the powders are complex substances difficult to analyze. However, Crowell,[6] in 1927, gave the following general description

of the material, which has never been stated better:

"Silicate cements differ from zinc phosphate cements chiefly in the composition of the powder. The liquids are solutions of phosphoric acid partially neutralized with zinc oxide and alumina, differing from zinc cements liquids only in the amount of water contained . . .

"The powders are made by melting together silica, alumina and fluxes and heating until fusion is complete. A high temperature, about 1400°C. is required. The resulting glass is crushed and ground to a fine powder.

"Several compounds have been used as fluxes. The earlier cements made in Germany, used beryllium silicate. Most of the cements manufactured in the United States use calcium fluoride. Calcium silicate, calcium borate, and soda-lime glass also have been used, but the resulting cements have been deficient in translucence."

In 1934 Matthews,[7] reporting on the quantitative analysis of two silicate cements, said, "Although such analyses provide a certain amount of information they by no means give full evidence as to the actual constituents of the powder." Again in 1935, when reporting a study of the effect of silicates on pulp tissue, he mentioned the complexity of the material and said that methods of analysis then in use gave no indication of the actual substances present.[8]

The results of an investigation, made by the American Dental Association in conjunction with the National Bureau of Standards, were made public in 1937. This investigation included the analysis of the twelve brands of silicate cements commonly used in the United States at that time and it showed the composition of these products to be basically as follows:

Silica	30-50 parts	by weight
Alumina	20-30 parts	by weight
Flux	balance necessary to make 100 parts.	

The fluxes are mostly fluorides of calcium and sodium, although oxides of these two elements were used in three of the twelve brands analyzed.

Chemical Reaction

The most important difference between silicate and zinc phosphate cements is in the reaction which occurs during the setting. When the latter sets, the formation of crystalline compounds is involved, but the setting of a silicate involves a very different type of reaction, the exact nature of which is not well known.

However, when the complex powder is mixed with the cement liquid a type of substance known in chemistry as a gel as formed. Hurd[9] gives an interesting discussion of the intricate processes which take place apparently in the setting of these gels.

Perhaps the best explanation of the composition and reaction of the silicate type of cements is contained in the summary of all the work done on siliceous materials at the National Bureau of Standards until early in 1942.[10] The mixing of a hypothetical silicate powder and liquid, the composition of which represents the midvalue of the twelve products analyzed, is described along with the general changes which appear to take place.

"Powder: Silica, 40 per cent; alumina, 30 per cent; lime, 10 per cent; flux, 20 per cent. Cement powders are produced from fused glass-like mixtures which have been chilled or crazed, and ground to very fine dimensions. In some instances zinc and other oxides are added to the powder before it is packaged.

"Liquid: Phosphoric acid, 50 per cent; water, 40 per cent; aluminum and zinc salts, 10 per cent.

"Mix the powder and liquid to a plastic mass. Plastic Mass: Surfaces of the powder are partially dissolved, forming a gel surface over each particle. The gel unites throughout the mass and usually sets when less than 20 per cent of the solid particles have been dissolved.

"The set Cement: A solid mass, 60 to 70 per cent of which is undissolved powder surrounded by the set gel."

Desirable Qualities of a Filling Material

In the first edition of his textbook, published in 1908, G. V. Black[11] lists five primary and three secondary qualities, desirable in a filling material. If one more quality is

added to the original primary list, one obtains a set of qualifications for an ideal filling material which are as basically sound today as they were when Black first issued them. This added quality can be classified as "non-irritating to the pulp" and was not included in 1908 because little was known about the vitality of teeth at that time. They were thought to be more or less inanimate objects embedded in the jaws.

Black's desirable qualities of a filling material follow:

PRIMARY

1. Indestructibility in the fluids of the mouth.
2. Adaptability to the walls of cavities.
3. Freedom from shrinkage or expansion after being placed in cavities.
4. Resistance to attrition.
5. Sustaining power against the force of mastication.
6. Non-irritation to the pulp (the only quality not given by Black in 1908).

SECONDARY

1. Good color or appearance.
2. Non-conductivity of thermal impressions.
3. Convenience of manipulation.

An Evaluation of Silicate Cements

A. Primary Requirements

(1) Indestructibility in the fluids of the mouth.

Most dentists have long considered silicate cements as little more than temporary filling materials because of the tendency to dissolve and disintegrate in the mouth. In 1928, A. D. Black[12] estimated that the average life of a filling made from silicate cement was less than two years, and he said that during much of this time the contact point is not maintained. Black's "Operative Dentistry" published in 1936[13] claims that silicate cement fillings are "definitely destructible in the fluids of the mouth," and the "solubility of these cements must be counted as a great factor against their use as a permanent filling material."

In the investigation of silicate cements, carried on by a group of 115 practicing dentists under the direction of the A.D.A. Research Fellowship, the average life of a silicate filling is estimated at 4½ years. Many of the dentists qualified their reports by saying that the life of the filling depended a great deal upon the mouth in which it was placed; in some mouths the filling would fail in less than 6 months while in a few others it might last for from 20 to 25 years. The chief reason for failure of silicate cement fillings, according to this investigation, is the solubility of the material.

Peyton [14] points out that silicate cements are, on the average, about ten times more soluble than zinc phosphate cements. He says, "It would seem that silicate cement should be a more satisfactory restorative material if it were soluble only to the extent of 0.5 per cent or less." (Present day silicates have a solubility of from 1.5 to 2.0 per cent.) "This is a phase of silicate research that needs to be given further study."

Several factors, some of which are under the direct control of the dentist, influence solubility to some extent. If the material is mixed thin, or if it is not protected from moisture while setting, the solubility is greatly increased. On the other hand, if not kept moist and protected from air after it sets the solubility is also greatly increased. Drying out accounts for the rapid disintegration of silicate fillings which often occurs in mouth breathers and people with a diminished amount of saliva. Another factor is the particle size of the powder. The larger the particle size the more soluble the product[15].

A review of the literature bears out Black's[13] contention, that, from the standpoint of indestructibility in the fluids of the mouth, silicate cement is the poorest restorative material used in dentistry.

(2) Adaptability to the Walls of Cavities

According to Black[13], "The adaptability of silicate cements is inferior to other filling materials." Van Leeuwen[16] states that silicate cement will not adapt itself well into sharp angles but if the cavity is undercut with a round bar, thus modifying the angles, the material will adapt itself very well.

The recent literature indicates that silicate cements have good adaptability to the walls of cavities, providing the cavities are properly prepared without sharp angles and bevels.

(3) Freedom from Shrinkage or Expansion

after Having Been Placed in Cavities
(Dimensional change)

Paffenbarger, et al[3], report, "The ideal silicate cement would be one which has a slight initial expansion on hardening and then remains constant in volume. Such a cement effectively seals the cavity and prevents the ingress of substances, such as stains, solvents and micro-organisms, between the cavity wall and the filling material."

Souder and Peters[17] have shown that the thermal expansion of the human tooth is about 8 parts per million per degree centigrade and that the expansions of silicate cement is about the same, while the expansion of amalgam is about three times as much. Therefore, if a tooth filled with silicate is subjected to the changes of temperature normally possible in the mouth, the cement and tooth should expand and contract approximately an equal amount. In this respect silicates are ideal filling materials and much superior to metals. Thermal changes should not cause disturbances of the margins, or develop pressure against the pulpal wall of a deep cavity.[10]

The shrinkage of set silicate cements is another matter however. Skinner[18] says that unfortunately a contraction always takes place. The group of 115 practicing dentists reported shrinkage as one of the four most common causes of failure of this type of restoration. Ray[19] showed that silicate cements shrank enormously if left in air for some time. Here, again is the reason for failure in mouth breathers and patients with a diminished amount of saliva.

According to Paffenbarger, et al[3], all silicate cements have a tendency to shrink. Generally the size and shape of the filling and the time at which it comes in contact with moisture after insertion affect the dimensional change. Variations in the mixing technic, as well as the powder—liquid ratio, and, according to Swanson[20], the particle size of the powder, all have their effects on shrinkage. From the standpoint of freedom from shrinkage or expansion, it appears that silicate cements are one of the poorest filling materials in use today.

(4) Resistance to Attrition and Sustaining Power Against the Forces of Mastication

These two qualities can be considered together since they involve compressive or crushing strength, hardness and other factors. For a fine description of the various items involved reference may be made to Skinner's[18] chapter, "Structure of Matter and Physical Properties of Dental Materials."

Souder and Paffenbarger[10] state that silicate cement is weaker than dentin, about two-thirds as strong as zinc phosphate cement and about one-half as strong as amalgam. But there are other factors that must be considered, one of which is brittleness, a property which the silicate cement exhibits to a considerable degree. Therefore, even though silicate cement is almost as strong as dentin, the cement will not absorb shock as dentin does and hence chips and fails under conditions of mastication where dentin might easily survive.

Skinner[18] states that the crushing strength of the silicate cements is probably the lowest of any of the dental filling materials. Poetschke[21], in 1916, observed that the compressive strength of silicates is greatly increased when these materials are stored in oil. This observation has been verified by many investigators since, but is of no practical value since, in the mouth, saliva is the only fluid that covers the fillings. Here again the powder liquid ratio has a bearing, in that the greater the amount of powder, the greater the compressive strength.

Black[13] states that silicate cements are not resistant to attrition and do not withstand the forces of mastication. The literature seems to bear out this contention.

(5) Non-Irritation to the Pulp

Silicate cements have for many years been thought to cause pulp death and the literature is full of references which so state. Careful investigation, however, tends to discount this impression, although there is still a difference of opinion among practicing dentists. The committee of practicing dentists mentioned earlier, was about evenly divided. Of the 106 replies to the question, "Do you believe that the silicate cements are more irritating to the pulp than are other restorative materials?" about 45 per cent an-

swered "Yes" and 45 per cent "No." The remaining 10 per cent was undecided. It will be seen from this survey that clinical experience has not answered the question.

Voelker[22] claims that out of a total of some 1300 silicate fillings observed over a period of 11 years he had very few pulp deaths, and that the few that did occur could be attributed to other causes than the material. There are three main factors which have been blamed for pulp irritation and death under silicate cement fillings. These are:

1. The arsenic present in the material.
2. The fluorides present in the material.
3. The acidity of the material.

While the presence of arsenic as an impurity in the silicate cements has been mentioned as a possible cause of pulp irritation, there is little or no evidence to support the claim. Skinner[18] states the probability of the presence of arsenic in harmful amounts is very small.

In the analysis of the twelve silicate cements, reported by Paffenbarger, et al,[3] the arsenic content varied from less than 0.0002 per cent to not over 0.0005 per cent. This amount is so negligible that it is considered to be of no consequence.

The presence of fluorine also has been considered as a possible cause of pulp irritation. However, this element is present in an extremely insoluble form. Crowell[6] soaked a silicate cement specimen in distilled water for two months and then showed fluorine to be present only to an extent of 1.007 per cent. He states that this amount would seem to be a negligible in consideration of the rigor of the test as compared to practical conditions in the mouth. Peyton[23] states that the fluorine present is in the form of a stable compound and is not liberated as fluorine.

The acidity of the material has been blamed more than the other factors for pulp irritation. Again, there is not much evidence in support of the contention. Skinner[18] states that all cements are acid while setting, yet the copper and zinc cements are not generally considered to have an injurious action on the pulp. Eberly[24] reported the pH of the cements, after being mixed for 30 days as follows:

Silicate	Zinc Phosphate	Copper
pH 5.5	pH 7.3	pH 4.8

Some o fthe best work on the acidity of silicate cements probably has been done by Paffenbarger, et al.[3] They found that silicate cement powders are, generally, slightly alkaline and the liquids are very acid, but with time, the acidity slowly decreases until, at the end of twenty-four hours, the material is approaching neutrality. They say that when the plastic cement is first introduced into the cavity, its acidity is relatively high, and it is probably at this time that the greatest injury to the pulp may occur. Injury is quite probable if the dentin has been drastically dessicated. They conclude that proper varnishing of the cavity floor and walls will eliminate any danger of pulp damage from acidity. Black[13] says that pulp death is not due to acidity but to shrinkage of the material which opens the way for bacterial invasion. Crowell[6] claims that the acid reaction does not cause pulp death and suggests that pressure of the material on the unprotected pulpal floor may contribute.

A survey of the literature indicates that, with good operative procedure, there will be no more pulp irritation under silicate cement fillings than under any other types of restoration.

B. Secondary Requirements

(1) Color or Appearance

Black[13] states that silicate cement restorations lead all others in appearance when first placed, and, in some few cases, will hold their original color almost indefinitely. He claims that the esthetic quality is the principal reason for the use of this material. Skinner[18] claims that the one outstanding advantage of the silicate cements is their ability to match the tooth structure when first placed, but that one of their many disadvantages is their tendency to discolor in the mouth.

Souder and Paffenbarger[10] say that the optical properties of the silicate cements account for their popularity, and they describe the capacity and refractive index used to standardize these properties.

Investigators seem to be rather well agreed that silicate cement fillings rank first in appearance at the time they are placed but that

practically all of them discolor to some degree with time. The committee of 115 dentists[1] gave discoloration as one of the major causes of failure of silicate cement fillings.

(2) Non-Conductivity of Thermal Impressions

According to Black,[13] the thermal properties of silicate cements are excellent and in this one respect they are probably better than any other filling material. This conclusion is confirmed by other investigators.

(3) Convenience of Manipulation

Most investigators agree with Black's[13] contention that silicate cements are easier and more convenient to manipulate than any other material tested for the general purpose of filling teeth. For the operator, experienced in the details of handling the cements, this statement is especially true.

Conclusions

This review of the literature indicates that silicate cements fall short of the most desired qualities of a good filling material. They must be rated far below gold, amalgam and porcelain in all but one of Black's[11] five primary qualities. This one exception, which is adaptability to the walls of the cavity, depends a great deal upon the preparation of the cavity. Silicate cements fare better in meeting the three secondary qualities. If their tendency to discolor in the mouth is excluded, silicates rank first in all of these qualities.

Skinner[18] considers silicate cements such poor filling materials that he feels that they should either be improved radically or discarded entirely.

Black[13] sums up the situation very nicely when he says, "The use of silicate cements has been a gamble in which the beautiful first appearance of the restoration has been the alluring element to both the dentist and his patient."

Despite the fact that silicate cements fail woefully in meeting most of the desirable qualities of a filling material, there is no possibility of the dental profession discarding them. Their ability to match tooth structure, plus their convenience of manipulation, will keep them popular until such time as a better material is found to take their place. Therefore, a summary appears to be in order of the several factors necessary to get the best service from a deficient material and prevent immediate failure of restorations made from it.

A. Recognition of Limitations of Silicate Cements:
   1. They should not be used in the mouths of people with a deficient amount of saliva, in the teeth of mouth breathers, or under gingival margins.
   2. They should not be used distal to the cuspids, nor in cavities which involve the incisal angle.

B. Preparation of Cavities:
   1. Cavities should not have bevels, nor sharp angles.
   2. Cavities should be well sterilized, and over-dehydration avoided.
   3. Floors and walls of all cavities should be varnished and, in deep cavities, the pulp should be protected with a suitable base.

C. Material and Manipulation:
   1. Use a material guaranteed by a reliable manufacturer to meet A.D.A. Specification No. 9.
   2. Follow the directions which accompany this material.
   3. Do not use ordinary steel, german silver or aluminum instruments.
   4. Cool the mixing slab to about 70 degrees but avoid cooling to the point where condensation occurs on the slab.
   5. Proportion the powder and liquid accurately.
   6. Do not use any liquid that shows a trace of cloudiness or sediment.
      a. Put the first drop of liquid back into bottle.
      b. Hold the circular end of the dropper parallel to the surface of the slab.
   7. Do not mix over one minute, but be sure to completely wet the mass.
   8. Get the thickest mix possible without interfering with suitable adaptation.*
   9. Insert the mix into the cavity promptly, keeping the cavity dry during the insertion.
   10. Wedge the matrix at the cervical and hold it still 3 to 5 minutes.
   11. Remove the matrix and cover the filling with varnish to protect against dehydration.

12. Do no finishing not absolutely necessary until a subsequent appointment, and use cocoa butter as a lubricant while finishing.

*Davis[25] advocates a stiff thicker mix and adaptation of the filling with a power mallet.

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A rebuke to members of the dental profession for indifference regarding dentistry for children is made in an editorial by J. O. McC. carried in the May 1945 *"The New York Journal of Dentistry."*

Calling it one of the few skeletons dentistry has in its closets, the writer censures guilty dentists for their signing of certificates of completion when there is still work to be done for the children to whom they give these certificates. He also points out that many of our members are ignoring dentistry for children while failing to assume a clearcut responsibility for referring them to sources where this dental work may be had. He takes no issue with those who have a reluctance to give dental care for children providing these dentists assume the obligation of reference. Neglect of the dental needs of children, the writer believes, will result in a loss of caste by the dental profession.

C. E. Martinek

From Our Secretary

In compiling the summary of the membership for the current year, your Secretary was impressed with many observations each of which was significant in its own importance. The first was the fact that the total active membership has reached a new high of 562, and further that the number of "drops" has reached a new low of only 26. In consideration of the fact that the War has distracted the professional incentives of many due to the heavy demands on our professional time available, and due to the fact that the parent body has been unable to be as active as would be normally permitted the Society at large can give itself a "pat on the back." This record, however, has not been made alone on the merit of the Society itself, but rather is due to the outstanding work and effort of the Unit officers and the unselfish contribution of their personal efforts and time in the interests of their individual Units and the parent body. In face of the forced inactivity of the parent body the Society owes to these and all members who have perpetuated and stimulated their interests in the A.S.D.C. a big debt of gratitude for a job well done.

The New York Unit has made the greatest achievements in establishing an active membership of 109 and losing only 1 as a "drop." This is a splendid achievement and it is hoped that the Society may further improve its membership rolls by learning of New York's programs of membership drives. California has re-activated the Southern California Unit and secured 22 new members with a total of 41. There are 12 active Units located in the Following states: California, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, Ohio, Pennsylvania, Tennessee, and Texas. Illinois and Oregon both have enough members to establish State Units and it is to be hoped that within the next year these two may be added.

Another significant phase of these membership figures is the evidence of increasing "foreign" memberships, especially in the Latin American countries showing an increasing interest in those things which are AMERICAN, and certainly the objectives and ideals of this Society in the dental and physical well being of children is truly American.

This being the last issue of the Journal for the 1945 series I wish to compliment the new editor and his editorial board for a wonderful job in bringing to us this "new" Journal of Dentistry for Children. Those of you who have liked its improvements should write to the Editor and his staff, and those who haven't should feel just as free to write and state why.

Prior to the arrival of the first issue of the 1946 series, statements will have been sent out from the office of the Secretary soliciting DUES. PAY them promptly to assure a continued and uninterrupted arrival of the Journal.

Now that World War II is over and traveling restrictions are released we can all look forward to the 1946 national meeting of the A.D.A., and our own meeting held in the same city a few days earlier. Pay your dues and be ready to attend that meeting, for it will be a dinger!!!

R. M. ERWIN, JR., *Secretary.*

Editorial Page

"The Dental Horizon"

In recent years there has been much criticism by members of the dental profession about the gradual decline of meticulous operative procedures. Such articles as "Is Operative Dentistry Failing"[1]; "The Inconsistencies of Operative Dentistry"[2]; "Contacts and Contours"[3]; are startling denunciations of the careless practices of those whose primary duty is to preserve the health and functional integrity of the teeth and the architecture that supports them.

The subject of economics is important in a topic of this nature because meticulous procedures take time and the element of time must govern our incomes. If we regard our work as valuable we will demand an intrinsic remuneration for that service. If we impart the value of that service to our patients they in turn will appreciate its worth. Surely the intelligent patient will understand that an operation that requires an hour is more valuable to them than one that requires a few minutes of the dentist's time. Why we as a profession are accustomed to selling restorations, treatments and replacements, instead of service is a question. The layman is used to service charges for work done by various tradesmen. No doubt one reason why there is a trend in dentistry to sell commodities instead of service is because it is presumed to be an easier selling point. We must remember that we are regarded as a health profession and there can be no set rule of values for each service rendered because the human anatomy presents various problems of pathological and functional nature, no two of which are alike.

In a practice where service charges are made there is usually no prejudice in regard to service for children. Those of us who have practiced dentistry for young patients are the recipients of a rich reward and a steadily growing practice. It was Black[4] who stated, "We are too liable to neglect little children; feel that operations for them are not of much consequence. But children make men and their friendship tells in later practice." What would the lay public think of the medical profession if our physicians did not regard the health of the children of this nation as a serious responsibility? The general lack of interest of the dental profession in the oral health of young patients is in all probability due to the fact that other dental procedures are more remunerative. There is no secret that for the time involved, the income for prosthesis is as a general rule much greater than the income for restorative dentistry. This fact is somewhat perplexing to those of us who are interested in the care and health of the natural dentition of our patients, and who enjoy an even practice which is less affected by economic fluctuations.

Dentistry for children is not an elementary phase of our profession. It is fundamentally important in that it offers the greatest field for the practice of preventive measures, often requiring meticulous skill which is demonstrated so favorably when exercised on adult patients. It is scientific to a degree that is unsurpassed in other phases of operative dentistry. Certainly the recent knowledge in the procedures of pulpotomies of the young permanent dentition is one of the outstanding accomplishments in dentistry.

Although one of the aims of dentistry is to give better health service to the young patients of this nation there seems to be a general lack of interest in that direction as evidenced in our professional meetings and dental literature. Pros-

thesis and oral surgery have held too dominant a place in all our activities, and it is these phases of dentistry which meet the attention of the layman. Surely we cannot encourage high school students to enter our profession unless they are acquainted with the health obligations of dentistry and are given a true picture of the preventive, restorative methods and esthetic results of operative dentistry.

There is a feeble attempt on the part of those who are relying on clinical restorative methods to overcome what the profession has failed to accomplish in the care of the oral health of children. There is no organization large enough in man power to rehabilitate the thousands of young dental patients through restorative methods alone. Dentistry's obligation must include the education of the public in the relationship of carbohydrate foods and caries. Some control should be exercised in the false advertising of energy producing sweets and the curative effects of dentrifices. There should be some stimulation by the health associations to encourage this nation to consume bread that is not made from refined flour.

It is the responsibility of the dental profession to emphasize dentistry for children in the programs of professional meetings, thus stressing the fundamental fact that beginning with the young child it should be the aim of every dentist to enable his patients to enjoy their *natural* dentition as long as possible.

E. CARL MILLER.

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Standards of Dental Health Care for Children*

"Health," according to Dr. Lawrence Henderson, of Harvard, "is that state which is good enough for the individual's purposes, which does not trouble him, and which he can therefore forget about." Dental health adapts itself quite readily to this practical yet comprehensive and thought-provoking definition, and it would seem logical to assume that any program designed to promote and maintain the dental health of a population group should provide for the complete fulfillment of the standards implied in this concept of health.

Paradoxical though it may be, the lay interpretation of dental health standards for children has demonstrated for many years that the public unfortunately is convinced that a considerably lower quantitative and qualitative level of dental service is required for children than for adults. Tragically enough, it also is true that a substantial part of the dental profession has allowed itself to fall under the spell of this same delusion.

If dental health for the child is to be "good enough for the individual's purposes," and who can deny that it should be, then adequate provision must be made for the functional and esthetic requirements which the teeth and oral tissues are intended to fulfill. If physical and mental growth and development are to proceed normally, without infective or dysfunctional or psychic interference, the child's dental health must be guarded and fostered to the fullest degree. The Child's Bill of Rights might well include the Four Freedoms of Dental Health:

Freedom from Pain.
Freedom from Infection.
Freedom from Dysfunction.
Freedom from Disfigurement.

Preventive dentistry must be the keynote in any program of dental care for children, but corrective dentistry, applied on an incremental basis, will constitute the backbone of the program. Where prevention is possible and practicable, preventive principles must be applied, but where limitations of knowledge preclude prevention, then corrective measures must be instituted quickly and effectively.

In proposing standards of adequacy, therefore, in programs of dental health care for children, the objectives are clearly defined: the child must be given all that dental and medical knowledge can provide for the establishment and maintenance of physical and mental health. Anything short of this admittedly must be inadequate.

To translate these objectives into action—to formulate a concrete program, embodying the standards of health service which the child has a right to expect and the dentist has a professional and moral obligation to provide, adequate dental health care for children, as proposed by the Council on Dental Health of the American Dental Association, must include:

1. Periodic examination, including x-rays, and prophylaxis.
2. Restoration of carious teeth, with silver amalgam or silicate fillings, or with metal castings if necessary.
3. Pulp treatments, including cappings, partial or total pulpectomies when indicated.
4. Anesthesia, where necessary for the control of pain.
5. Preventive orthodontic appliances, to maintain space and prevent malocclusion.
6. Prosthetic appliances, when needed to replace missing teeth, provide function and restore esthetics.
7. Treatment of periodontal disease and mouth infections.
8. Extraction of hopelessly diseased, impacted or supernumerary teeth.
9. Surgical procedures where necessary for the health of the child.
10. Parent and patient education, to encourage the application of scientific knowledge for the prevention of disease and the promotion of health.

P. E. BLACKERBY, JR., Dental Director,
W. K. Kellogg Foundation; formerly
Dean of the University of Louisville,
School of Dentistry.

**Dentistry*, v. 6, Sept., 1945.

What is the status of the children in your practice? During the last four years of unusual conditions have those youngsters received conscientious care or have they been tolerated? Have many dentists forgotten the old axiom "that the boy of today is the man of tomorrow"? Thank goodness most dentists have kept both feet on the ground and have cared for the young people properly. For those who haven't a reckoning is not far in the future. Their present practice of adults will be lost from their practice for one reason or another and their future practice will be meager and senile. What about themselves? Does not the presence of a young person especially of late grade school age or of high school age issue a challenge to your ingenuity and skill? I know of nothing greater to keep you "on your toes" than a couple of wise cracking, "sharp" juveniles during the day!

Murray A. Leitch, President,
Detroit District Dental Society
in the *Detroit Dental Bulletin*

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AROUND THE COUNTRY—

Really can't blame you fellows for neglecting to send in news this trip. The much welcomed summer vacations are over for most of us and we must "dig in" to prepare for our winter "vacations".

From *Walter McBride,* "Since hearing from you I've spent my hard earned dough for a boat trip in the upper lakes and thoroughly relaxed myself. I ate and slept, then slept some more and 'et' again. And I read a good deal which I have little chance to do on the job. I'm quite like you—though I'll have you know not anywhere near as bad—in that my eyes close on my book or newspaper after a long day in the office."

To prove that the "News Editor" is not entirely sleepy—I spent a week's vacation with the family and not once did I go to sleep while reading. (I did *not* read!) With my wife and two ACTIVE boys (ages 9 and 13) we hied ourselves to Long Lake, seven miles southwest from Traverse City, Michigan. Fishing, a day at Boy Scout Camp, Rotary, an evening concert at Interlochen, with swimming in between jumps—really served to keep one awake.

From the *Missouri S.D.A. Journal:*

President Brandhorst recommends a seven point dental program for the children of the State:

1. For every child a regular oral inspection.
2. For every child instruction in oral hygiene.
3. For every child relief from pain, regardless of finances.
4. For every child regular care from 3 years of age through high school.
5. For every child considerate attention to all defects.
6. For every child guidance to normal facial development.
7. For every child the right to the services of American Dentistry.

Postwar return of service dentists—

The distribution of dental officers by size of city of intended practice indicates that prewar shortages in rural areas will be accentuated by the trend toward cities of 5,000 to 10,000 population.

Note—Baldwin City, Kansas, is an example of the real service to be rendered by a dentist in a rural area. The need for dentistry for children in the rural area is as great as in the urban area, and the economic return is commensurate with the service rendered.

The Toronto Dental College announces a program of post-graduate courses in all branches of dentistry. Of special interest to A.S.D.C. members is the two weeks' course covering Dentistry for children, starting January 14. Orthodontics is offered as a four weeks' course commencing January 28. These courses are designed to aid the general practitioner and returned service dentists who desire further study in certain phases of dental practice. For complete details address *Dr. A. D. Mason, Dean,* Faculty of Dentistry, 230 College St., Toronto 2B.

Konrad Lux's new address: *Comdr. K. Lux, D.C.U.S.N.R., U.S.N.* Base Hospital No. 18, Navy No. 926, F.P.O. San Francisco, California. *Konrad* has been overseas for over a year but with cessation of wars we hope he can return to our fold soon.

Testifying before the Senate hearing on Bills 1099 and S. 190, were some of "our" boys—*Allen Gruebbel, Vern Irwin* and *"Ken" Easlick.* 'Tis said that *"Dr. Easlick* offered the most detailed information on the possibilities of child dental care programs, leading to the conclusion that a program started with the 3 year olds and carried through to age 18 would in fifteen years materially lessen the load of dental needs."

From Cleveland, *Carl Miller* reports the enrollment of five new members to our Buckeye unit. *F. T. Loukes* and *R. I. Durham* of Cincinnati, and *Al Saad, Harvey Janke* and *Leon Neuman* of Cleveland. *Dr. Neuman* is president of the Cleveland Dental Society, *Dr. Janke* is general chairman of the 1946 Annual Children's Dental Health Day, while *Al Saad,* known to certain of his friends as *B.D.,* has charge of Public Relations for the meeting.

From Okinawa comes word of *Clare Edmunds,* Michigan Unit member who left the good old U.S.A. last July. Writes he: "The islands are pretty, but the natives live primitively and dirty. No sanitary facilities—they just step out the front door of their huts, have their B.M., and walk back in—leaving the disposal for the pigs or whatever takes to that sort of stuff!" All we can say is: "Don't bring those habits home with you, *Gus,* we're proud of our front lawn!"

George Harris, former secretary of the Michigan unit, writes from the Pacific that he is "ready any time to come home".

Charlotte Greenhood, D.D.S., Chairman of the Division of Dental Hygiene, College of Dentistry, University of California, San Francisco, is conducting a survey of research projects in dentistry for children. If you know of any such work being done, she would appreciate information.

Our worthy president, *Ralph Ireland,* devoted so much attention to his golf game during his month's vacation that he missed the deadline with his "Message". We enjoyed your article "Operative Technics for the Tooth and the Child" in the September Journal of the A.D.A., *Ralph.*

While down in Detroit on a business trip last month, *Al Seyler* showed me a prescription given by a physician to the mother of an 18 month old child for "Taxi" liquid. Sig. "To be applied to the teeth daily." It is a sad commentary on the ethics of a physician who not only invades the practice of dentistry, but prescribes a solution of hydrochloric acid to remove stains from a child's teeth. Sorta made my blood boil!

Dynamic *Carl Miller* is again chairman of the Fourth Annual Children's Dental Health Day Program, sponsored by the Cleveland Dental Society. *Carl* is already "ear deep" in the preparation of his program. Why don't you lay aside your office for the first Monday in February and show the boys in Cleveland that A.S.D.C. members are interested in *Carl's* educational meeting?

Belated news, but welcome:

The Greater New York Council on Dental Health consisting of representatives from the First and Second District (State of New York) Dental Societies recently passed a motion that every possible effort be made to bring to the attention of Dental Societies that they be urged to institute courses in dentistry for children in the operative, preventive and public health aspects.

The Southern California branch of the A.S.D.C. held its regular meeting in May.

Dr. Morley Sellery, Director Health Service Section, Los Angeles City Board of Education, presented the subject, "The School Health Administrator Looks at the Total Health of Children."

Dr. James David McCoy, Past President International Association of Orthodontists presented, "The Orthodontist Looks at the General Practitioner's Responsibility Toward the Preventive and Control Aspects of Dentistry for Children."

"The General Practitioner Looks at the Economic and Professional Aspects of Dentistry for Children," was presented by *Dr. Cecil S. Dickinson,* Past President of the Southern California State Dental Association.

Jack Wisan, A.S.D.C. President-elect, and Chairman of the Membership and State Unit Committee, is on the "war path" again. *Jack* writes, "Undoubtedly you will agree with me that the future of dentistry for children rests largely in the private dental office to the extent that if we can encourage more and better dentistry in private offices, we will accomplish much in the interest of child health."

The basic element of this column should be news of the A.S.D.C. members and unit activities. Please take a minute, a postcard, pen or pencil, and help us keep this department interesting. I'll appreciate your cooperation!

Stan Brown
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Pulp Tissue Reaction to Instrumentation During Cavity Preparation

JOHN E. CHRIETZBERG, D.D.S., M.P.H.
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Dental operators who use rough-friction technics in cavity preparations should visualize the cooking of the odontoblasts as an egg is poached, or the dentin charred like a strip of bacon. Many dentist would be humiliated, degraded, and even dismissed, if the patients were to know the true reason for many of the post-operative difficulties that are encountered.

There are some dentists who realize pulp pathology can be produced by improper instrumentation. Others fail to recognize the trauma that may be produced, especially in primary and young permanent teeth. Injury to the pulp tissue has been attributed to extensive amalgam fillings, silicate cement fillings, and deep seated cavities, when careless rough use of revolving or large dull burs is the cause. Those using blunt careless technics border on the line of gross negligence.

In a general practice child patients become a disappointment when their primary teeth abscess or cause great discomfort following restorations. These same restorations would serve their purpose satisfactorily in permanent teeth where regressive changes in the pulp tissue have taken place.[1]

Nuckolls[2], describing the morphology of the pulp cavity of deciduous molars, and its relation to dentin, and enamel, states that, "deciduous pulp cavities have certain characteristics in common," namely:

1. "The form of the pulp cavities roughly compares with the surface form of the tooth except that the horns of the pulps are longer and more pointed than the cusps indicate.
2. "As in the pulps of the permanent teeth, the mesial horns of the deciduous pulps are longer than the distal horns.
3. "The occlusal wall of the pulp cavity in the region of the central pit is depressed to a marked degree as in the pulps of the permanent teeth.
4. "The deciduous molars should be classified into two types: the high cusp type and the low cusp type, the length of the pulpal horns corresponding, in part, to the surface form.
5. "The dentin outline is similar to the outer form of the enamel.
6. "The enamel of the deciduous teeth is thinner than that of the permanent teeth.
7. "Taking into consideration the form of the pulp cavity, the long mesial pulpal horns, the large size of the mesial portion of the pulp, and the relatively thin dentin, a satisfactory mesial cavity preparation in any deciduous molars becomes a most difficult operation.
8. "While a secondary deposit of dentin has been observed in the region of decay, this secondary deposit characteristically does not lessen the extent of the pulpal horns unless the decay occurs on the occlusal surface involving an area immediately over the pulpal horns."

During cavity preparation these significant characteristics always should be clear in the mind of the operator, as a more skillful operating procedure is required than the ordinary practitioner provides. Fish[3] realizing the importance of the histologcial structure of the dentin in the preservation of the pulp tissue during cavity preparations, carried out a number of experiments with human, monkey and dog teeth. Freshly cut cavities in the dentin were filled with a dye solution, sealed in and left for a number of hours. The dye penetrated through the tubules and stained the pulp. From this experiment it is reasonable to suppose that the tubules can and do conduct heat very readily to the pulp tissue, which may cause temporary injury or devitalization of the tooth.

In discussing sensitive sections of the teeth, Bodecker[4] points out that the most albuminous portions are the most sensitive areas, and are four in number: (1) The pulp located deep within the tooth enclosed within the pulp chamber. (2) The dento-enamel junction where the terminal ends of the tubules, enamel spindles and tufts appear. (3) The granular layer of Tomes appearing in the dentin at the dento-cementum junction where the tubules of the root dentin convey the impulses to the pulp tissue. (4) The interglobular spaces in the dentin which are usually found in double or single rows running parallel to the dento-enamel junction. The lines of the recessional horns of the pulp should be mentioned as another sensitive and dangerous area. These sensitive points are indicators to the operator that he is approaching the areas where pathology may develop if caution is not applied.

Kronfeld[1], speaking of poorly calcified dentin, indicates that it can be improved to some degree by additional precipitation of lime salts. He said, "The course of dentinal tubules is much less regular in secondary dentin than in primary dentin, therefore, it is called irregular dentin. Secondary dentin contains less organic substance than primary dentin, and is less permeable: In this way it is capable of protecting the pulp from injury or irritation from without." Six causes are known to promote or stimulate the formation of secondary dentin; abrasion, erosion, dental caries, *dental operations involving the dentin,* fractures of crowns without exposure of the pulp, and advanced age. The dentin may become opaque, and secondary dentin is often laid down in the pulp chamber. Opaque dentin with an underlying layer of secondary dentin serves the same purpose in tooth protection as scar tissue to other portions of the body.[5]

In Fish's[3] experiment with dyes on dogs and monkeys, two types of reaction to injuries in the dentin were observed. One, the contents of the dentin tubules had died and sealed off the pulp by the addition of secondary dentin. Adjacent tubules were also blocked off from the pulp with a calcified material. The second type, the contents of the injured tubules had survived in some cases, and were blocked off from the pulp by plugs of calcified material, called hyalin material, deposited in the peripheral ends of the tubules. Some cases showed that additional primary dentin had been deposited at the pulp margin in response to the stimulus of the injury.

Schultz[5] asserts that hyperemia of the pulp often is caused from injuries to the dentinal tubules, and that secondary dentin is formed at the ends of the tubules, encroaching on the pulp tissue, decreasing the value of the pulp organ. He thinks that irritation from heat generated, or by physiological imbalance in cavity preparation may create hyperemia in the pulp chamber. If excessive hyperemia is created, pain will be experienced after the operation for ten days or two weeks. When the pain ceases the pulp has died, or calcification in the pulp chamber has taken place. Initial hyperemia will respond readily to treatment if the cause is removed.

Jeserich[6] thinks that physiological form should be included in the text books in cavity preparation. It would include the methods of instrumentation that should accomplish the desired purpose with the least amount of injury or disturbance to enamel, dentin and pulp tissue. He points out that the careless use of rough disks, stones, and burs which transmit undue thermal changes to the pulp in grinding, drilling, and polishing operations, may cause hyperemia. The removal of metallic fillings requires extraordinary precaution, as heat is conducted very readily through them. It is possible to increase or raise the temperature from 25° to 40° in the pulp chamber by the careless use of revolving instruments.[6]

Bodecker[7] points out that heat generated by rapid revolving burs on the dentin will immediately seal off the tubules, with which the instrument is in contact, producing excessive heat in approximating areas. Heat approximating the sealed tubules causes the lympth in the tubules to expand and inflate the odontoblasts, causing a pressure, or injury to the pulp tissue. He states further that, "Epinephrin in procaine anesthetic solution with its constrictor qualities reduces the cooling effect of blood upon the pulp."

Willis and Warner[8] infer that heat, in excess of that which soft tissues can tolerate, can

be reached in the pulp chamber during cavity preparation. The local temperature at the bur can excede 250° centigrade, while the temperature in the pulp chamber two millimeters away may be only 50° or 60°. Indicating that dentin is a poor conductor of heat.

Sommer,[9] discussing degenerative changes, clearly describes the action taking place in the pulp chamber following severe irritations. The shock to the pulp may cause an active hyperemia in the arterioles, whose boundaries are confined in the unyielding pulp chamber, making it difficult for normal circulation to exist. The active hyperemia may soon be followed by passive hyperemia in the veins, and pulpitis is almost certain to result. The use of dull burs and indiscreet cutting of dentin often produce the hyperemic condition. He also thinks that, in many cases when the operator attributes the death of the pulp to a metal restoration, actually careless operative technics are to blame.

Henschel[10] places the tolerance zone of average vital dentin from 85° to 130° Fahrenheit. His clinical experience leads him to think that even the smaller burs used at second speed with four pounds pressure would generate heat from 98.6° to about 233° or even to 368° Fahrenheit on the grinding spot. He emphasizes that this temperature is not reached in the pulp tissue, much of it being lost or absorbed in the dentin, saliva, or the air. The least amount is directed toward the pulp. The injury to the tubules should vary from severe at the grinding spot to a very minute injury in the tubules, receiving only a slight thermal reaction.

Thomas,[11] experimenting with chilled burs, prepared like cavities under similar conditions with chilled and unchilled burs. In one of these cases only slight pain was experienced and the other excessive pain was evident. The pulps of these teeth showed no clinical evidence of reaction. Upon extraction 72 hours after the cavity preparation, small hemorrhagic zones in the pulp tissue approximating the odontoblasts under the cavity preparation were found. With thin enamel and larger pulp, the primary and young permanent teeth should necessarily experience a greater amount of pathology than the older permanent teeth.

The thermo-couple described by Jeserich[6] and used by Thomas,[11] appears to be the most accurate instrument to measure heat changes in the pulp cavity. Henschel's[13] method of finding the tolerance zone was to use vials mounted on a metallic bar with a small flame projected on one end of the bar, each succeeding vial was found to be cooler than the approximating one nearest the flame. The comparison of unlike material would make it rather difficult to conclude that the same results would be obtained in tooth structure. Brass is an excellent conductor of heat while dentin and enamel are relatively poor. Henschel may have some method to measure the relationship which he failed to explain in his paper.

To indicate the action taking place in the tubules and odontoblasts when heat is applied on the tubules, Bodecker[7] used brass tubes filled with water with one end closed and the other covered by a rubber bag. The bags would inflate when heat was applied to the tubes, and deflate immediately after the removal. This experiment is subject to the same error as Henschel's, as metal tubes were used to compare with dentinal tubules.

Willis and Warner[8] used the thermo-couple type instrument, capable of measuring 0.1° temperature changes, for measuring heat generated within the pulp chamber. They used freshly extracted teeth embedded in quick setting plaster. The thermo-couple was inserted through a small opening into the pulp chamber, in most cases this opening enters through the plaster into the root of the tooth. In other instances the thermo-couple was inserted in the opposite side of the tooth from where the heat was to be generated. The tooth was then inserted in water slightly warmer than the oral cavity. As soon as the water reached body temperature the tooth was withdrawn and grinding began. Temperature rises up to 70° centigrade were recorded in the anterior pulp chambers during drilling. Only 60° centigrade was reached in the posterior. More local heat was produced when grinding enamel than dentin. A greater temperature rise in the pulp chamber was

noted while the dentin was being drilled. It was shown that a temperature of 250° centigrade, two millimeters from the pulp only produced a 50°-60° temperature centigrade in the pulp tissue, which is above that of the tolerance of protoplasm.[8]

Methods used to prevent pulp pathology vary considerably. Schultz[5] recommends that in a difficult cavity preparation a simple outline should first be carried out, then add the difficult portion of the preparation. He indicates that cavities with sharp angles invite failure and should be avoided.

Bodecker[7] thinks that many pulps are lost by the use of anesthetics during cavity preparation and more will be lost if operators do not use more caution. Jeserich,[6] and Willis and Warner[8] agree that the use of small sharp burs with less than four pounds of pressure in second speed will prevent or aid in the prevention of much pulp tissue reaction caused by the heat of revolving burs. Jeserich[6] thinks that intermittent drilling and cutting in only one direction with the fissure bur will aid to reduce the heat generated.

Henschel[13] has the opinion that thermal control is necessary to prevent trauma and all cavity preparation should be carried out under a continuous flow of warm water. He contends that a spray of warm water can eliminate intermittent drilling, but light pressure on the bur should be used. Confining the operation to the use of small burs is unnecessary if the water spray is used.

According to Sommer[9] the properly timed use of radiography will enable the operator to locate cavities early and do the restoration before there is danger of irritating the pulp. Good radiograms will give the operator an opportunity to determine the individual anatomical structure of the tooth, pulp cavity, dentin, and enamel. He also implies that injury or exposure of the pulp tissue can be caused by the removal of stained dentin immediately over the pulp chamber.

Thomas[11] in his experience with chilled burs shows that much pain is eliminated, but there is little or no significant difference in the pulp tissue pathology.

Fish[3] concludes that secondary dentin and dead tracts in the dentin are natural barriers, and that the secondary dentin always corresponds in its distribution to the tract or injured tubules.

Stress has been placed on the anatomical and histological structure of the pulp and dentin to encourage operators to make studies and comparisons of the vital tooth structures. A constant review of these subjects is imperative for the successful operator. The use of good bitewing radiograms during an operation will aid in maintaining a knowledge of the variations that exist in pulp, enamel, and dentin form. Bitewing radiograms are essential in dentistry for children as there is a considerable variation of the structure of primary and young permanent teeth when compared with those teeth that have undergone regressive changes.

Pathology of the pulp varying from slight hyperemia to putrescence often may be produced by rough or careless instrumentation. Hyperemia may be produced in primary and young permanent teeth very readily, the dentin being comparatively thin. The grinding spot is much nearer the pulp tissue than in the older permanent teeth where secondary dentin, or dead tracts are present. The extent of hyperemia produced is in proportion to the number of injured tubules involved. The number of tubules is decreased in dead tracts, and where secondary dentin appears, a more extensive cavity preparation can be performed without serious injury. If a rigid technic of extension for prevention is employed, a greater number of tubules is involved, a larger number of odontoblasts is destroyed, and the chance for the pulp tissue to return to normal is decreased proportionately. A conservative, or modified cavity preparation is indicated on primary and young permanent teeth as a measure of pulp preservation. It also adds to the comfort of the child and improves the disposition of the operator.

Excessive irritation[5] from revolving instruments may coax the pulp tissue too far, resulting in a pulpitis. Pain will be continuous for a week or ten days, tapering off to a gradual decline or suddenly stopping. The sudden stop is not an indication that the tooth has returned to normal, or that secondary dentin

has been laid down as a protection. It may be possible that the pulp has died, leaving no clinical evidence of pathology. In other cases secondary dentin has been laid down, offering its protection, while the pulp tissue has returned to its normal function. It is an excellent procedure to use the pulp tester on all filled teeth two or three weeks following restorations. Polishing could be acomplished at the same sitting.

Adjacent to the injured portion of the dentin pulpal abscesses may be produced within the pulp chamber. The more extensive injuries may cause putrescent pulps or periapical abscesses. Deep seated periapical abscesses involving large areas in very young children may disturb the development of the permanent teeth.

Anesthesia, the best practice builder dentistry ever has employed, is contraindicated to hide hasty cavity preparation and excessive heat generation. Many operators, expecting to provide the maximum amount of dental service with the minimum amount of pain, depend upon the effect of procain products and additional equipment to do so. With the combination of these potent facilities the operator can accomplish his desired objective, even with the use of over-size dull burs if he uses excessive pressure and generates heat far in excess of the tolerance zone of the pulp tissue. An operator with volume as his primary objective, who gives no thought to the pathology that may be produced, should be required to review the literature of men like Bodecker, Sommer, Fish, Jeserich and Henschel before he is permitted to carry on with a tooth killing clinic. Anesthesia should not be employed in children's dentistry if the clinician is inclined to be hasty or careless during operative procedures. The proper use of anesthetics during cavity preparation is quite advantageous to the careful operator, especially with children, in localities where the health authorities have taught through their immunization program that needle injections are not to be feared.

No single method to prevent pulp injury during cavity preparation has been perfected sufficiently to control all factors. A combination of several methods will minimize pulp irritation caused from instrumentation. A constant reference to bitewing radiograms during cavity preparation should be as routine as the removal of the decay before fillings are inserted. Bitewings mounted on the bracket table will impress the patient with the value of their routine use. The anatomical structures can be observed, permitting the operator to gauge the depth and extent of the cavities, the amount of non-carious tissue between the drilling instrument and the pulp cavity, or pulpal horn. Knowing the position of the bur in relation to the pulp cavity the reckless operator will become more moderate with his pressure when he realizes that injury may be inflicted in this area. Many rely on the patient's reflexes to determine the amount of drilling that can be tolerated, giving little thought of the anatomical outline of the pulp cavity that the tooth possesses. When water is used to counteract the heat generated, thermal changes in the pulp tissue may be minimized. This technic, too, has its disadvantages, in that the operator's view is obstructed and he is not always permitted to determine the approaching danger points. Operators using water-control technic are in more need of bitewing radiogram than the operator using the dry field.

Summary and Conclusions

1. The combined use of bitewing radiograms with small sharp burs at medium speed, with not more than four pounds pressure, using intermittent drilling in only one direction, with a knowledge of anatomical variation of the pulp cavity, will decrease tooth mortality and morbidity to a marked degree.
2. There is a need for a constant review of pulp anatomy and histology of the enamel and dentin to be aware of the physical pathology that may take place during cavity preparation.
3. The amount of trauma produced during cavity preparation depends on the number of tubules involved, the amount of heat generated, and the nearness of the pulp cavity to rapidly revolving instruments.
4. Hyperemia and pulpal abscess caused from injury during instrumentation may

be followed by secondary dentin with the pulp retaining its normal function, or pulpitis may result showing no clinical evidence of degeneration, and in other cases suppuration and periapical abscesses are the final result.

5. Young permanent and primary teeth require a more skillful operative technic than the permanent teeth that have undergone regenerative changes.

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The Influence of Habit Patterns on Prevention and Control in Pedodontics*

GEORGE W. TEUSCHER, M.A, D.D.S., M.S.D.

Editor's Note:

George Teuscher, prominent Chicago A.S.D.C. member, and a graduate of Northwestern University School of Dentistry, was a student of the late Blaine Rhobotham. He is Director of the Department of Pedodontics at his Alma Mater, national secretary of Omicron Kappa Upsilon, and numerous national dental societies, and yet finds time to lecture to many dental groups. I hope we hear further from you, George.

A. E. S.

*From the Journal of the Wisconsin State Dental Society.

The dentist is faced with issues, peculiar to pedodontics, when he operates for children. These may be placed in three general groups. The first is that which deals with problems of child behavior. The second concerns itself with the education of the child and the parents. The third involves the many technical problems of adequate child care. All of these should be considered in terms of the *child* as a dental patient.

It is not the purpose of this paper to discuss at length the many problems to be found in the groups referred to above. Rather its purpose is to show the relationships that exist among them, and to face honestly and frankly the consequences that may accrue from those relationships. The dentist who fails to recognize the latter will increase many fold the difficulties confronting him.

Theoretically it should be possible to prevent many of the dental ills endured by children today. That list includes dental caries, gingivitis, malocclusion, and their sequelae. While it is readily admitted that there are exceptions to this, even theoretically, it is not admitted that research has failed to show strong advances in prevention. Dental caries has been materially reduced and in some in-

stances entirely eliminated by placing patients on low-carbohydrate diets. The control experiments at the University of Michigan and at Northwestern University furnish convincing evidence on this point.

Gingivitis is more prevalent in children than is generally realized. Usually, however, it is not considered as a serious problem. True, one seldom encounters detachments of the peridental membrane in children's mouths, but certainly disease should not be permitted to extend to the destruction stage before it is considered worthy of treatment. The dentist's attention is focused on destroyed or lost tissues, and it may be this situation which explains at least in part, his failure to recognize in many cases forerunners of tissue destruction, such as gingivitis. It has been shown that the latter can be successfully treated in the majority of children by removing stains and debris found on the teeth, establishing a well-balanced diet, and by strict adherence to daily mouth care.

Approximately 20% of all malocclusions are associated in varying degrees with one or more of the abnormal mouth habits, such as thumb-sucking, finger-sucking, lip-biting, tongue habits, etc. Others are attributed to the premature loss of deciduous teeth, tardy eruption of permanent teeth, prolonged retention of deciduous teeth, improper dental restorations, loss of permanent teeth, etc. All of the factors just named can be prevented.

Why then is prevention practiced so little? Let us glance for a moment at the field of medicine, and its efforts to prevent disease. Preventive medicine has, through the use of vaccines and anti-toxins, made great strides in the mass control of contagious diseases, such as small pox, typhoid, diphtheria and scarlet fever. It has controlled others, such as measles, tuberculosis, and venereal disease, through isolation and early treatment. It has not, however, been successful in preventing the common cold, cancer, appendicitis, stomach disorders, and heart disease. What then is the important difference? Does it mean that medicine has failed to learn anything about this latter group which would prevent its frequent recurrence among our population? It does not. Where medicine has been successful in preventing or controlling disease, it has been aided by law, or a deep public sentiment which has been established by all public agencies lending their whole support in stamping out disease. The common cold, on the other hand, is approached from an entirely different angle. It is not unlawful nor poor social taste in most circles for an individual to appear among others when suffering from a cold. It is entirely up to him whether he isolates himself or pursues measures in his daily living to prevent colds.

In dentistry all prevention is up to the individual immediately concerned. There is no statute that says that any individual who partakes in excessive carbohydrates and develops dental caries has committed an unlawful act. There is no social stigma attached to caries susceptibility as long as the person has his dental ills cared for, at least those which affect the anterior teeth. This is considered proper, even though the parent who partakes of a diet rich in free sugars will probably subject his child to the same diet, and may, therefore, be indirectly responsible for the cavities in the child's teeth. This is not an argument for control by law. It does indicate, however, a doleful lack of public health education. Through the latter channels, the results will be of much greater significance than if people are forced by law to follow medical advice.

When prevention is directly up to the individual concerned, a series of closely related problems is disclosed. The person who makes an essential change in his personal habits does so only after a reinterpretation of the value of those habits to his mode of living. The person who succeeds in breaking himself of the smoking habit does so because he has convinced himself that smoking is of less value to him than not smoking. The individual who succeeds in restraining himself from partaking of a diet rich in carbohydrate does so because he has convinced himself through a reinterpretation of values that less carbohydrate is of greater value to him than more carbohydrate. The problem cannot, however, be dismissed quite so simply. Many a patient has left the dentist's office "convinced" that he must brush his teeth oftener

and more carefully and that he must stop putting sugar on everything that he eats. But for some reason he does not stay convinced. Some might say that the dentist used the wrong argument. They may be right; the chances are, however, that they are wrong. What is of much greater importance, in fact, one might say the only thing of importance, is what the patient does with the information furnished him by the dentist. It may be that the person considered himself convinced at the time of exit from the doctor's office; but, absence makes the heart grow fond again for the old tastes and pleasures.

If the information received from the dentist is really to mean anything, the person concerned must think about it in terms of his own problems. True, it is, that he must have faith that the information is reasonably correct; but further than that he must weigh the consequences of not following the information against the consequences of not following it. His decision in such a reinterpretation of values will decide whether or not the advice of the dentist will be followed. It may be well that the individual will decide that his indulgence in sweets is worth more to him than freedom from dental caries and gingivitis. The writer knows of a few cases in which the patient reached such a decision after a consideration of the values involved. One should find no serious objection to this insofar as one individual is concerned. After all it is his life to live.

When such a patient is, however, a parent, another problem arises. Children are deeply affected by their environments. Their values will in a large measure be those of their parents. It is too much to expect children to avoid sugar when their parents partake of it in large quantities. The eating habits of the child will be largely guided by the eating habits of the parents and others with whom they have their meals regularly. The writer could describe many cases where the parents were very willing and for a time insistent that the child reduce the amounts of such foods, but who were not willing that they themselves should change their own diet habits. They were willing to treat the problem only as they would treat the matter of taking medicine—it is good for you, but bad for me. But even there the analogy in the argument above, could be shown to work, for many glasses of milk and many spoons of cod liver oil have been swallowed unwillingly by parents just to get their children to do the same.

Until parents are made to see and understand their relationship to their children insofar as habits are concerned, dentistry cannot expect to do much with prevention of dental disease. A worker in public health education argued recently that children can be used to educate their parents. It was his opinion that talks in the school room would prove of great benefit to the dental health of the pupils and that through the information brought home by these pupils to their parents the necessary changes in diet, living conditions, home care and visits to the family dentist would be made. Undoubtedly, some progress is shown by such means, but a child's set of values is established first, by association with his parents and second, by his emotions. It is not established by a consideration of the consequences of acting one way or the other. A few years ago, during health week, students in a large high school were given cards which entitled them to free dental and medical examinations. Out of 8000 students, 13 took advantage of this opportunity. Figures are not available as to whether any of the 13 went any further than the examinations.

This does not mean that dentistry should stop it efforts to prevent dental disease through efforts to gain the cooperation of its patients, but it ought to recognize fully the difficulties it faces in undertaking the task. Occasionally one will be found who will consider the problem as suggested above and who will continually reinterpret it in terms of changing conditions. Many can be found who will cooperate for a few months, but who then return to their old habits.

If the assumption in regard to prevention is correct, what course can dentistry follow? Certainly it shall not give up in its attempt to prevent disease. It shall, however, recognize the difficulty which it confronts in doing so. Further it shall realize that its course for the present is one of control rather than one of prevention.